

effect a 180 degree shift of generator **10** output in lieu of the phase shift adjustment described above utilizing knob **22** of sound generator **10**.

[0043] Referring now to **FIG. 3**, there is illustrated in a logic flow diagram one of Applicant's preferred sequence of steps to accomplish Applicant's phase shift treatment for mono-frequency tinnitus patients. In Step **1** a patient's eligibility for the phase shift treatment is determined in a medical-audiologic tinnitus patient protocol (MATPP) or similar medical protocol. The medical-audiologic examination determines if Applicant's phase shift treatment is appropriate for the patient and what if any cause can be ascribed for a particular patient's condition. As is known to those skilled in the Tinnitus Medical and Audiologic Arts, tinnitus classification generally employs four major factors: (1) localization, (2) intensity, (3) sound types or composition, i.e. pure tone or complex tones, and (4) temporal variability of the tone(s). At present only pure tone, non-drug induced monofrequency tinnitus appears appropriate for this first evolution of Applicant's phase shift tinnitus treatment program. For a more complete understanding of MATPP see "Medical-Audiologic Tinnitus Patient Protocol" in Shulman, Chapter 15.

[0044] Steps **2, 3** and **4** provide for the subjective "sound-typing" by the patient which generally involves matching the output of an external sound wave generator to the tone (frequency) and amplitude (loudness) to his/her monofrequency tinnitus tone. In accordance with Applicant's preferred embodiment, this patient subjective "sound-typing" is accomplished in a soundproof environment illustrated as movable member **36** in **FIG. 1**, in a sequence of at least five sequential trials, each on a blind basis, where the patient is not able to determine visually the output of the sound generator by viewing any of the dials or displays on the sound generator **10**. If there are any major differences in the multiple "sound-typing" steps further tests are conducted to ensure octave confusion or other errors by the patient are not involved.

[0045] In Step **5**, utilizing the subjective patient data from Steps **2, 3** and **4**, a pure tone sinusoidal wave form from the external sound generator is generated which is substantially identical to the patient's tinnitus tone in both amplitude and frequency.

[0046] In Steps **6** and **7**, the generated sinusoidal wave form is sequentially phase shifted through a series of steps a predetermined amount ($\delta 1, \delta 2 \dots \delta n$ as shown in **FIG. 2**). Where the predetermined phase shift increments add up to at least 180 degree phase shift relative to an arbitrary reference and where the generated tone and the patient's tinnitus tone are the same frequency and amplitude, the generated tone is brought into a reciprocal, cancellation relationship with the patient's tinnitus tone. This sequential phase shift iteration is useful and indeed necessary in practicing this embodiment of Applicant's sequenced step phase cancellation treatment because at present there are no instrumentation processes to directly measure the phase relationship between a patient's monofrequency tinnitus tone and the externally generated sinusoidal tone. However the incremental 180 degree shift brings the generated sound wave at some point into a reciprocal relationship (i.e. canceling) relative to the patient's tinnitus tone.

[0047] In the alternative direct or essentially one step embodiment described above, there is no need for the

sequential or incremental phase shift steps described in Steps **6** and **7** of **FIG. 3** as the desired phase shift of 180 degrees is implemented directly or in essentially one motion by using the phase shift feature of sound generator **10**. As previously described, the respective output wave forms of sound generators **10** and **16** may be algebraically added or summed to produce wave form or tone cancellation as shown in **FIG. 2**. Such total tone cancellation feature of this embodiment is significant for Applicant's improved monofrequency tinnitus patient treatment because it conveniently verifies the identical match between the treatment tone and amplitude with the subjective patient determined tinnitus tone and amplitude or loudness which has been found to be useful. Thus in lieu of the sequential, phase shift steps described in Steps **6** and **7** of **FIG. 3**, in this alternative embodiment the output wave form of sound generator **10** is directly shifted through 180 degrees to bring it into phase canceling, reciprocal relationship with the output of sound generator **16** and the phase shifted output wave form of sound generator **10** is then applied to the tinnitus patient directly via headphones **12** for a predetermined time period preferably in the order of ten minutes per treatment.

[0048] The phase shift of the generated wave form is preferably accomplished utilizing a phase shift feature of the Agilent sound generator **10**, as hereinabove described. Alternatively the sequential or direct phase shift of the generated wave form may be accomplished in a phase shift network **32** which as described above the output of which may be selectively coupled to the patient's headset **12** via switch **32**. In either instance, these phase shift increments or direct phase shift step may be manually selected by the attending audiologist/physician or it may be automated using an appropriate timing circuit, not shown, in conjunction with the phase shift network **32**. In either event within Applicant's preferred embodiment, each increment or direct step of the phase shifted wave form is preferably coupled to the patient's headset **12** for a period in the order of 10 minutes and in utilizing the incremental steps each incremental phase shift is in the order of 20 degrees whereby a patient treatment for the full 180 degree shift would be in the order of 90 minutes. For the direct step phase shift embodiment, the shifted waveform is likewise coupled to the patient's auditory system for a predetermined period of time, preferably ten minutes.

[0049] Step **8** is intended to enable the attending physician and the patient to subjectively evaluate the effectiveness of a phase shift treatment in minimizing or alleviating entirely the deleterious patient tinnitus condition. A patient diary is preferably kept to record data at predetermined intervals after a phase shift treatment is completed and thereafter at several daily intervals before the next treatment. The diary should record patients subjective data regarding the loudness of his/her tinnitus tone (e.g. on a 1-10 scale where 1=0 or negligible loudness, 5=intermediate loudness and 10=very loud. Preferably the patient diary additionally includes data regarding: 1) where does your tinnitus tone appear to be located? 2) if more than one location, which location is worse? 3) has your tinnitus tone changed appreciably or does it appear to be more than one tone? and 4) does the location of your tinnitus tone tend to fluctuate in tone or loudness? Data from the patient's diary is useful in planning subsequent patient treatment routines and schedules.